NASA Aviation Safety Program (AvSP)
Weather Accident Prevention Project (WxAP)
Weather Information Communications Element (WINCOMM)

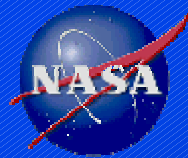## *WxAP Annual Review – Future*
November 21, 2002

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Remaining Challenges

Challenge #1

- Comprehensive aviation weather information requirements do not exist

Approach

- Reconcile existing documentation into a conclusive set of requirements

- Act as a catalyst for the development of an accepted concept of operations

- Identify datalink operational limitations that, together with weather product prioritization, will determine weather information capabilities

Remaining Challenges
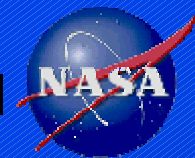
Challenge #2

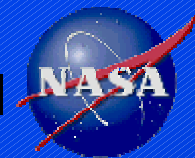- Reduce the cost of aviation weather datalinks

Approach

- Leverage broad user base commercial technologies where possible

- Develop innovative multi-use solutions utilizing existing and/or planned equipage

- Exploit multiple links in a hybrid or non-standard architecture to provide a total system solution

Remaining Challenges

Challenge #3

- Weather information communication solutions must be integrated into the current/planned NAS structure
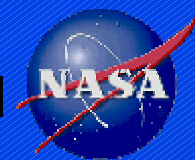
Approach

- Develop models and perform simulations using high fidelity realistic operational scenarios

- Provide near term solutions through innovative use or enhancements of existing equipage

- Investigate future planned datalinks to influence use or design

Addressing the Challenges
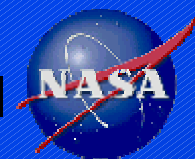## (Major Topic /Task Areas)

- **Transport / Cargo En-Route**

- **General Aviation / Regional En-Route**

- **Terminal/Surface Area**

- **International / Oceanic**

- **GA/Transport Communication Solutions**

WxAP: Weather Information Communications

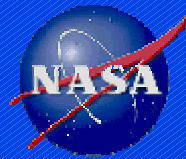## Transport / Cargo En-Route

- **AWIN Products**
  - **Graphical Imagery**
  - **Textual Products**
- **Datalink Connectivity**
  - **Ground to Air**

- **Turbulence Products**
  - **Graphical Imagery**
  - **Warnings and Alerts**
- **Datalink Connectivity**
  - **Air to Air, Air to Ground, Ground to Air**

WxAP: Weather Information Communications

Transport / Cargo En-Route

**Communication Links Selected**

- **1090 ES**
  - **Air to Air & Air to Ground Turbulence Data.**
  - **Link is Inadequate for Ground to Air Graphical Imagery and Textual Products.**
  - **Software updates required to open unused registers and standards modification for update rates/cycle.**

- **Honeywell FISDL**
  - **Ground to Air for AWIN and Turbulence Data.**
  - **Higher altitudes than planned but could provide text products reducing the load of ACARS (& future VDLM2).**

WxAP: Weather Information Communications
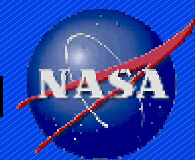
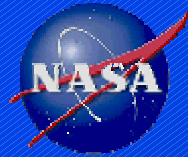## General Aviation / Regional En-Route

- **AWIN (non-TAMDAR) Products**
  - **Graphical Imagery**
  - **Textual Products**
- **Datalink Connectivity**
  - **Ground to Air**

- **AWIN (TAMDAR) Products**
  - **Graphical Imagery**
  - **Warnings and Alerts**
- **Datalink Connectivity**
  - **Air to Air, Air to Ground, Ground to Air**

General Aviation / Regional En-Route
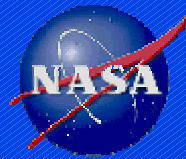
Communication Link Selected

- **UAT**
  - **FAA ADS-B link decision for GA was UAT.**
  - **Use of ADS-B minimizes TAMDAR link bandwidth demands Air-Air and Air-Ground through elimination of redundant TAMDAR/ ADS-B data.**
  - **Link meets all requirements.**
    - **Air-Air, Air-Ground, and Ground-Air connectivity, latency and throughput.**
    - **Data/Message structures and standards for UAT support transmission and reception with changes limited to software modifications and standards update.**

Terminal/Surface Area

Communication Link Selected

- **VDLM2**
    - **Guaranteed Message Delivery**
    - **Full Duplex**
    - **Good Coverage**
    - **Not fully explored for Weather Dissemination**
        - **What capacity is available for Weather?**
        - **What products are suitable to transfer?**
        - **What is the justification and impact of Weather on a highly critical datalink with CPDLC and AOC traffic?**

WxAP: Weather Information Communications
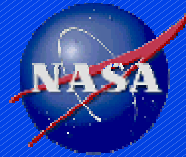
International / Oceanic

**Communication Link Selected**

- **Swift-64 (INMARSAT)**
  - **High percentage of U.S. International / Oceanic aircraft are already equipped with an Aero-H antenna.**
  - **Cost effective solution for this scenario.**
  - **Circuit Switched Mode of Operation is currently used for cockpit services.**
    - **Move to Packet Mode of Operation while maintaining high reliability and integrity of critical data.**
    - **Will require a cost effective method to provide separation of cockpit and cabin services.**

WxAP: Weather Information Communications
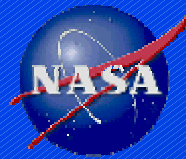
GA/Transport Communication Solutions

**Supporting technology for broad aviation user/service base**

- **Radio on a Chip (Honeywell CRA)**
  - **Will enable handheld low cost VDL avionics.**
  - **Both transmit and receive functions will be provided minimizing required external components.**
  - **Radios using this chip will be programmable to all of the VHF aviation NAV/COMM bands.**

- **Aviation Cellular**
  - **Investigation of a 4G aviation cellular capability leveraging 3G commercial cellular networks.**

System Engineering
(Support Tasks)
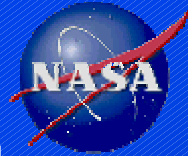
Conclusive Requirements for Graphical Weather to the Cockpit (JHU-APL)

- **Produce a final integrated, comprehensive requirements document resolving existing discrepancies in data rates, products, assumptions, formats and compression of graphical weather products.**

VDLM2& VDLM3 System/Network Models and Simulations (Honeywell)

- **Previous efforts/studies used a limited number of ground stations which minimized interference effects.**
- **System level performance of an operational network with different message sets and criticality.**

Technology Validation
(FY03 WxAP Integrated Flight Support)

FY03 WxAP Flight Campaign

GRC LearJet

LaRC B757

Terrestrial Link (Turbulence Information)
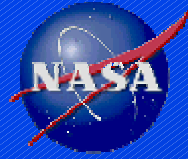
Iridium Ground Station

AHAS & EWxR

GRC Ground Station

Weather Information Service

Summary

- WINCOMM is focusing future efforts on Major Topic / Task areas that are:

    - Specific – Product/Phase-of-Flight/Datalink

    - Measurable – Progress can be tracked

    - Achievable – Prior work lends credibility

    - Reasonable – Supported by equipage and links

    - Time Table – Near term payoff and far term seed